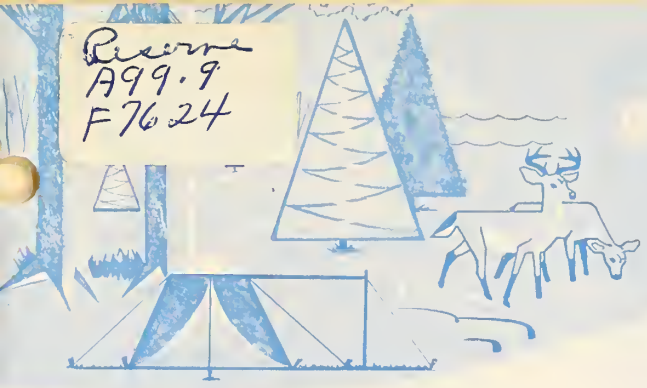

RESEARCH NOTE LS-72

LAKE STATES FOREST EXPERIMENT STATION · U. S. DEPARTMENT OF AGRICULTURE
St. Paul Campus, University of Minnesota, St. Paul, Minn. 55101

Influence of Temperature and Early Spring Conditions on Sugar Maple and Yellow Birch Germination in Upper Michigan

For many years, workers at the Upper Peninsula Experimental Forest have observed sugar maple germinates protruding through the snow in the spring. They have alsc noted that yellow birch germination is always later than that of sugar maple. This Note documents the ability of sugar maple to germinate beneath a snow cover and indicates variations in temperature requirements for germination of sugar maple and yellow birch.

Sugar maple seed matures in early fall and is dispersed during leaf drop. Yellow birch seed also matures in early fall, but it is dispersed gradually throughout the winter months (Benzie 1959). In this climate, yellow birch seed is often windblown for great distances on top of the snow crust that occurs after mild thaws. Cross sections cut through the snowpack in late winter reveal concentrations of yellow birch seed on these crusts, which are formed at different depths.

Temperature requirements for germination of yellow birch seed may vary with the time of seedfall (Tubbs 1964); those seeds naturally stratified early in the season germinate early in the spring while those stratified later germinate in midsummer. Observations on the time of germination have shown that the bulk of the natural seedfall germinates in early June.[1] Recommendations for laboratory germination tests are for alternating temperatures of 50°+ and 90° F. (U.S. Forest Serv. 1948).

Sugar maple has often been observed germinating at stratification temperatures (U. S. Forest Serv. 1948) of 41° F.; recommended test procedures specify temperature alternation either of 50° and 77° or 68° and 86° F.

During April 1964 several locations in mature northern hardwood stands were visited while snow still remained over appreciable areas. On April 30 one location was selected for photographs. Pictures of the snow surface, leaf surface, and area directly under the previous year's leaf litter were taken from exactly the same camera position (figs. 1-3). The pictures show that sugar maple seeds germinate beneath the snow under a leaf layer where, according to Geiger (1959), temperatures may be only slightly above freezing and relatively uniform. Yellow birch seeds, on the other hand, are usually found in the snow cover where dormancy-breaking conditions may not be as favorable.

Also during April 1964, seeds of yellow birch and sugar maple, collected the previous fall and stratified for 90 days, were germinated in petri dishes placed in incubators. Incubator temperatures were 34°, 41°, 50°, and 68°F. Total numbers of seeds tested were 1,602 for birch and 317 for maple. The test was run for 30 days. Results were as follows:

Temperature	Percent germination[1]	
(°F)	Yellow birch	Sugar maple
34	0	87
41	6	35
50	14	8
68	9	2

[1] Percent of filled seed.

This collection of observations indicates that sugar maple germinates best under very low temperatures and, in natural environments, will germinate under a snow cover. Yellow birch, on the other hand, germinates best under more moderate temperatures, and these seedlings do not appear until after the sugar maple seedlings, which are able to utilize early season moisture supplies and growing space. In some circumstances, however, yellow birch seedlings attain greater height than sugar maple when both start from seed (Tubbs 1963).

[1] *Unpublished data on file at Lake States Forest Experiment Station.*

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CARL H. TUBBS
Associate Plant Physiologist

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FIGURE 1 (top). — Yellow birch conelet bracts and seeds litter surface of melting snow on April 30 in a northern hardwood stand on the Upper Peninsula Experimental Forest. The overstory is composed primarily of sugar maple of seeding age, but seldom are maple seeds observed on top of or within the snow cover even after a bumper seed crop. Right arrow indicates yellow birch seed; left one points to bract.

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FIGURE 2 (middle). — Removing the snow from the exact spot shown in figure 1 to the top of the previous fall's leaf layer reveals no seed of any species. The leaves are compressed into a soggy mat, which is often partially frozen. Spring ephemerals have pushed through the mat (arrow).

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FIGURE 3 (bottom). — When the top leaf layer shown in figure 2 is removed, the ability of sugar maple to germinate underneath a snow cover in early spring is revealed. Arrows point to germinated seed. In those areas sampled on the Experimental Forest, the bulk of the sugar maple seed was found under a layer of lea whereas yellow birch seed occupied the top the snow as illustrated in figure 1.